Systems Engineering Analysis: Littoral Undersea Warfare in 2025

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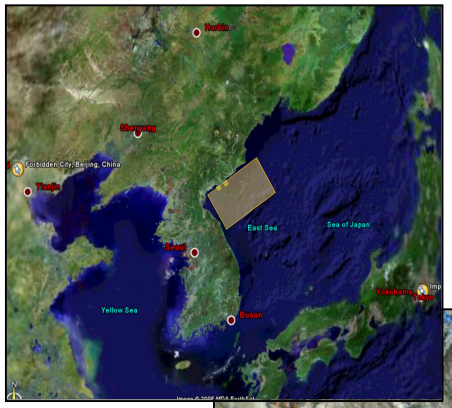
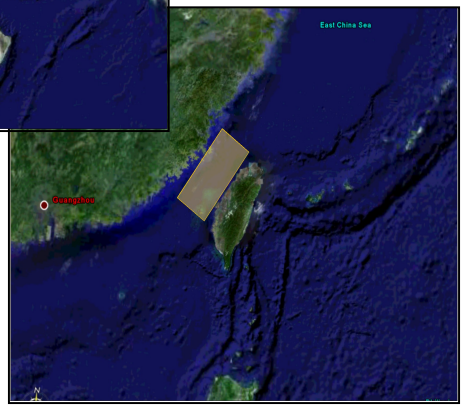
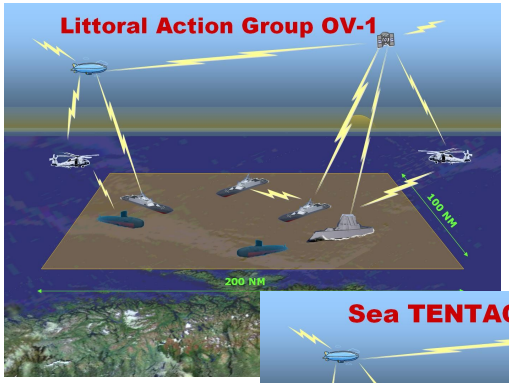
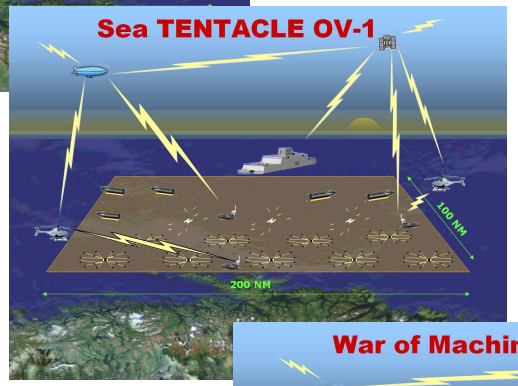
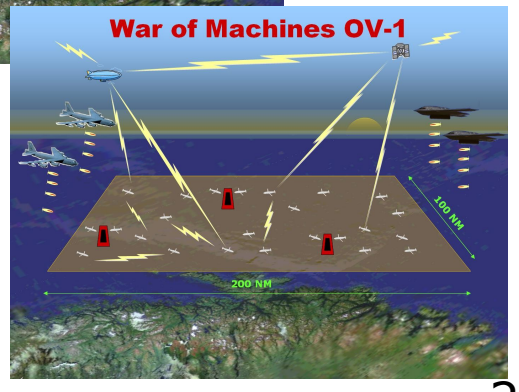
SEA-8 Tasking







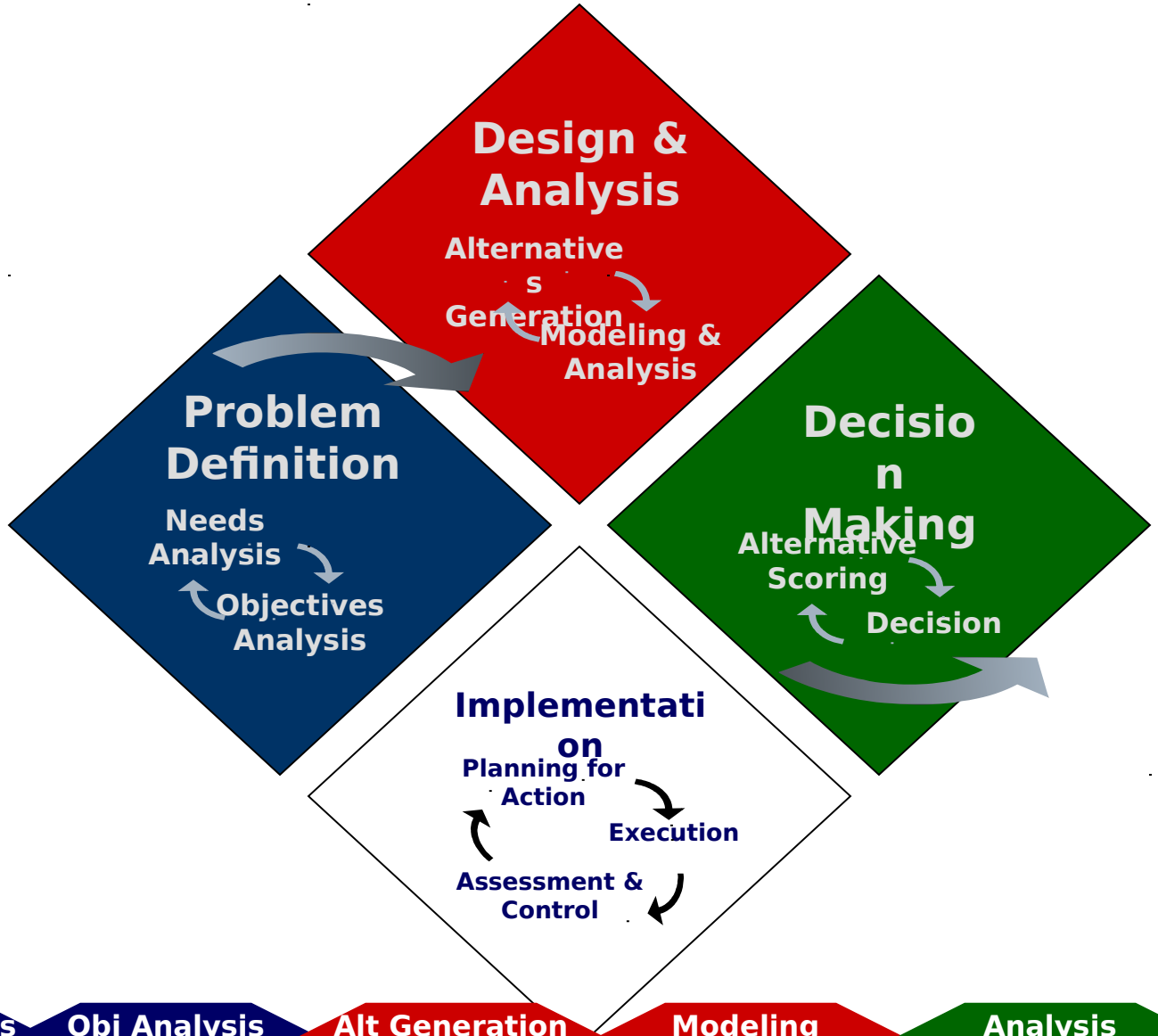




Bottom Line Up Front

- Systems engineering principles
- Insights and conclusions:
  - 1) No perfect system
  - 2) Reaction time
  - 3) Persistent systems
  - 4) Kill-Chain Timeline (KCT) tradeoffs
  - 5) Undersea Joint Engagement Zones (UJEZ)
- Results qualified and quantified during brief

Systems Engineering Design Process



SEA-8 Problem Statement

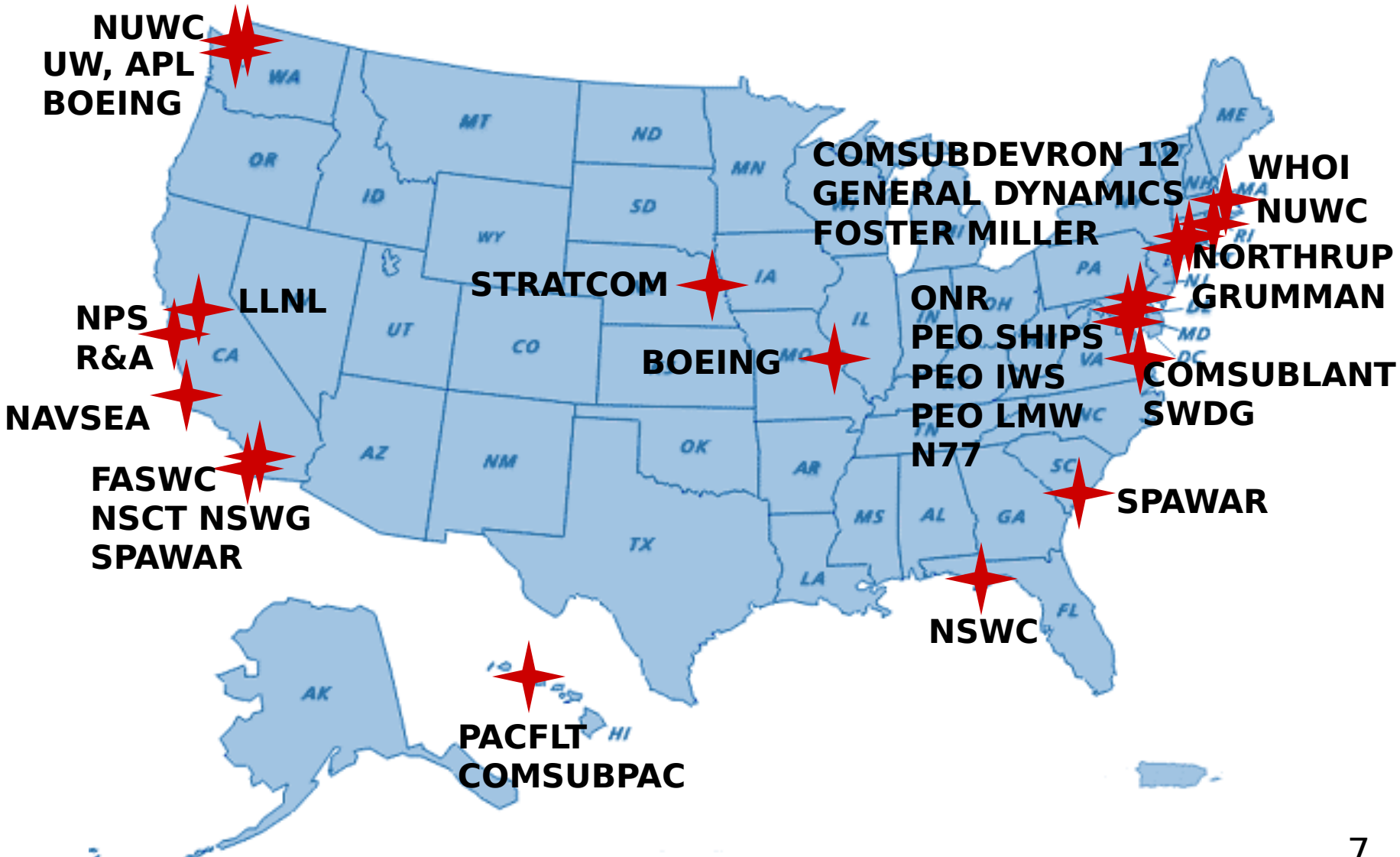
- **SEA-8**

  .. design a system that denies enemy undersea forces (submarine and UUV) effective employment against friendly forces within the littorals during the 2025 timeframe.

Problem Definition Phase

- Needs Analysis
  - Primitive Need
  - Stakeholder Acknowledgements
  - System Decomposition
  - Input-Output Modeling
  - Functional Analysis
  - Requirements Generation
  - Effective Need

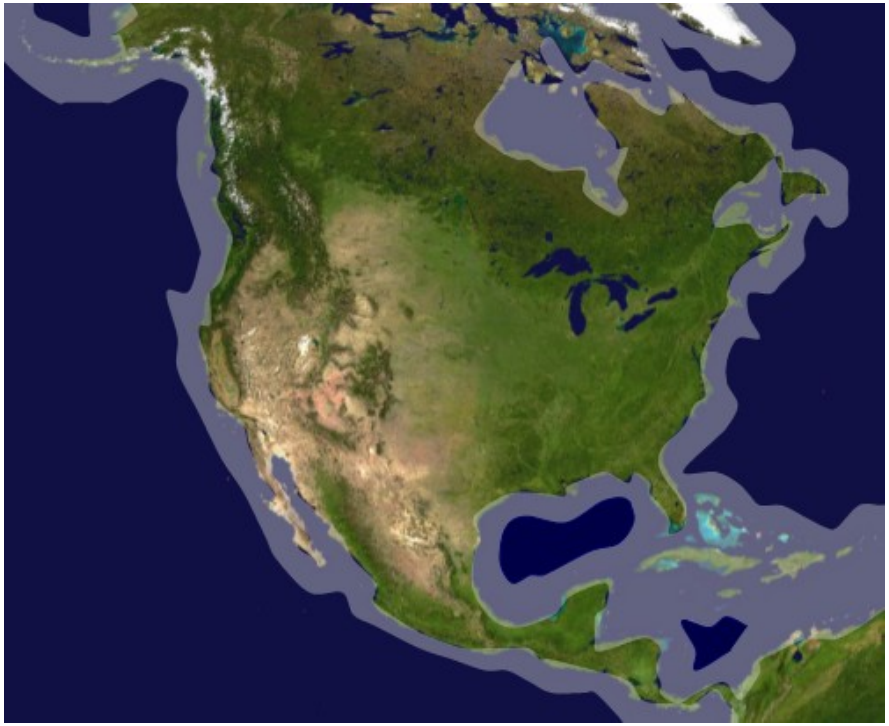
Stakeholder Acknowledgements

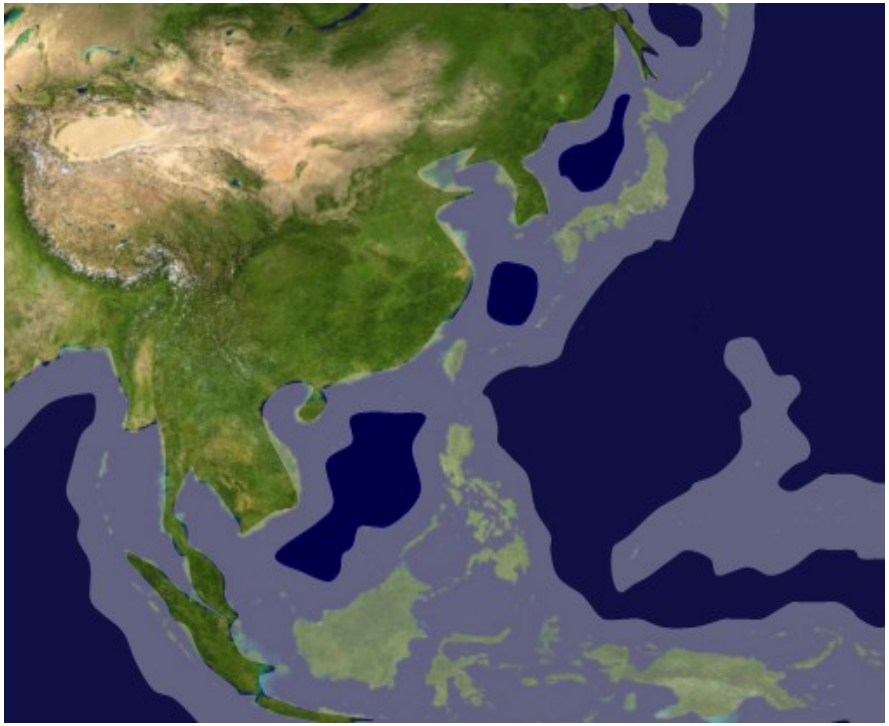


Littoral Defined

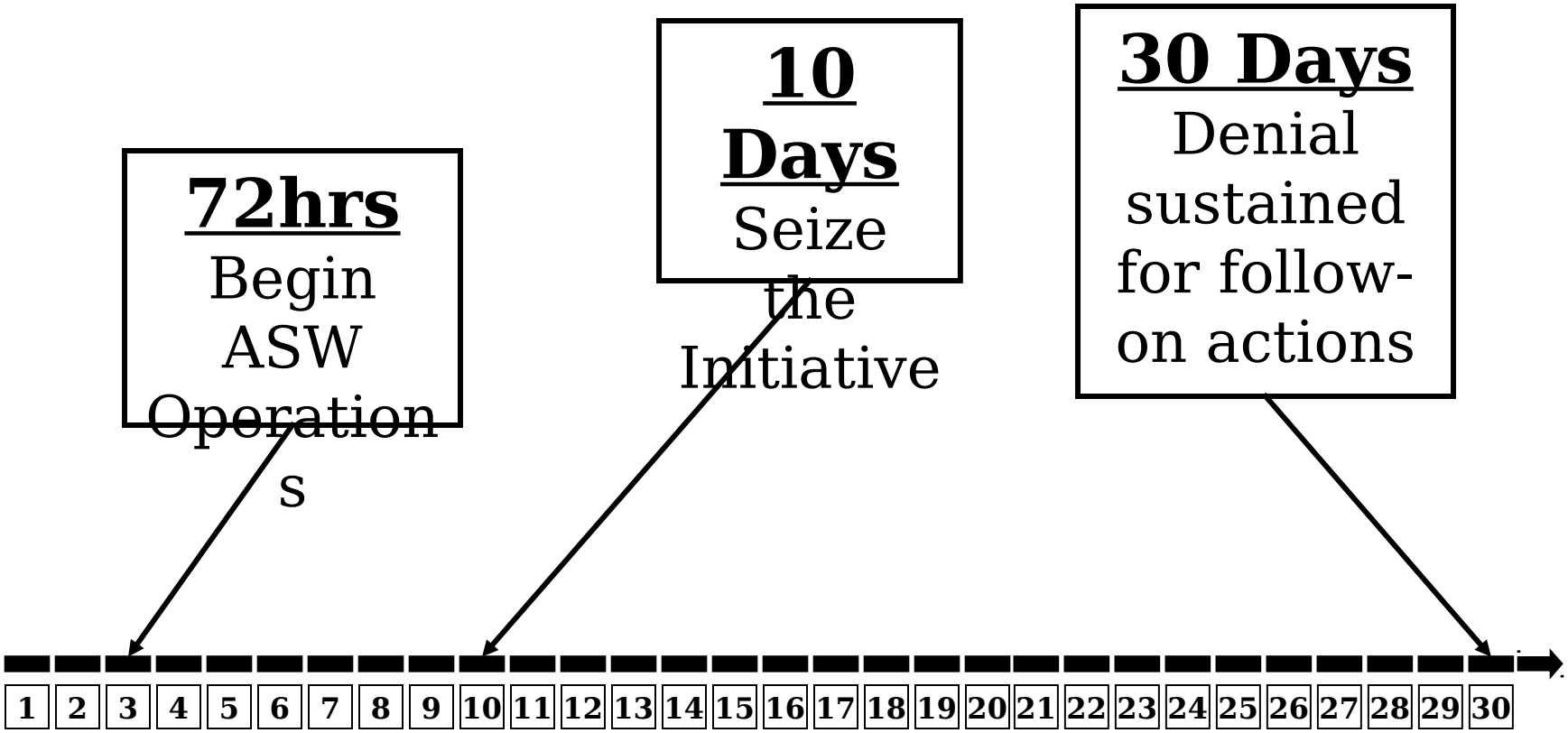
Littorals:

Defined as waters within 100nm of any oceanic shoreline.



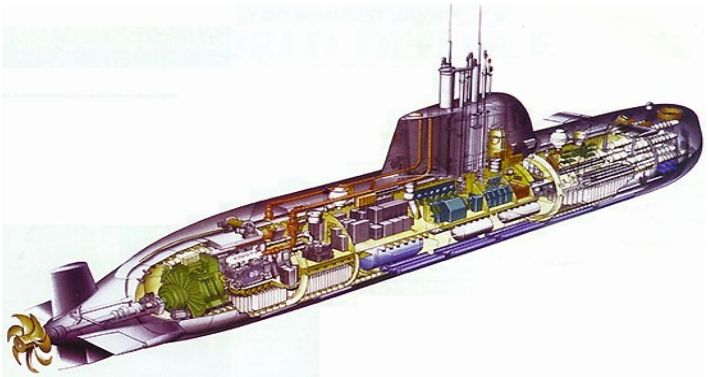


ASW Timeline 3/10/30



Littoral ASW Points

- Littoral ASW Threat
  - Air Independent Propulsion Submarines
  - Fuel Cell Technology Submarines
  - Nuclear Powered Submarines
  - Diesel Powered Submarines
  - Unmanned Undersea Vehicles

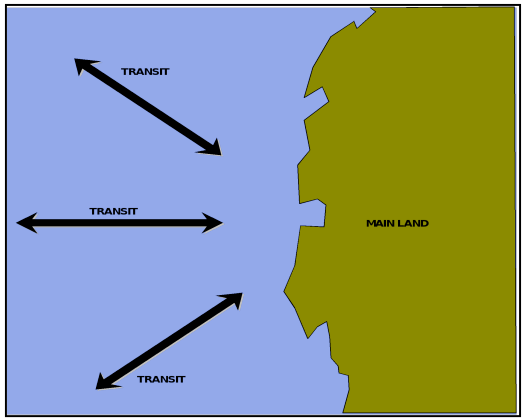


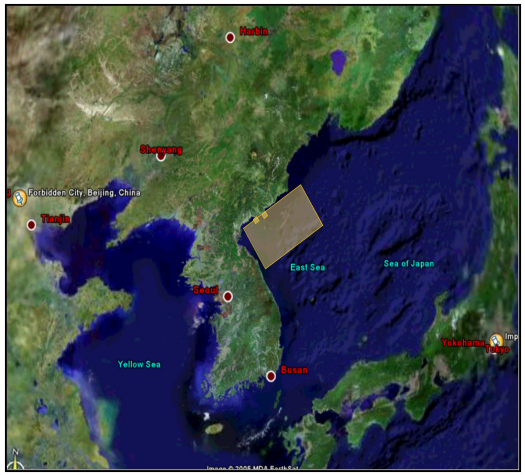
Objectives Analysis Phase

- Objectives Analysis
  - Functional Objectives
  - Measures of Effectiveness
  - Measures of Performance
  - Performance Goals

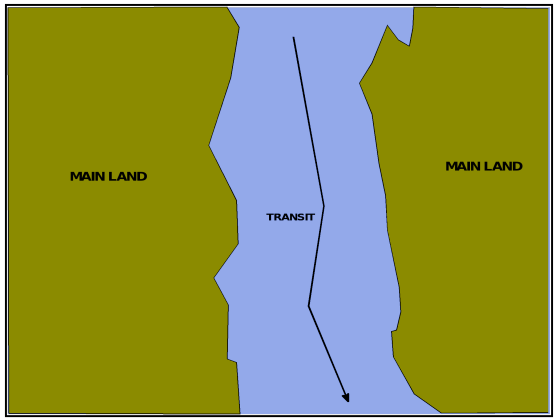
Scenario Building

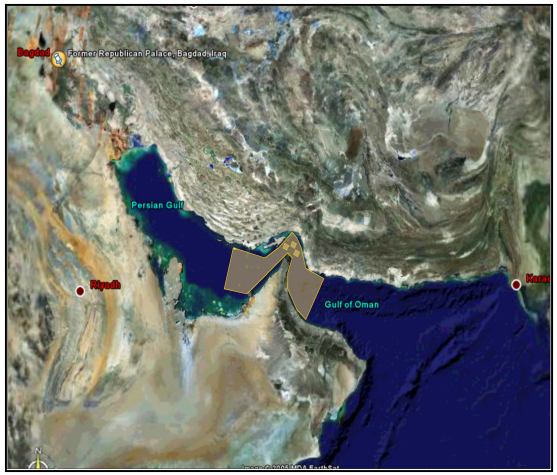
Coastal



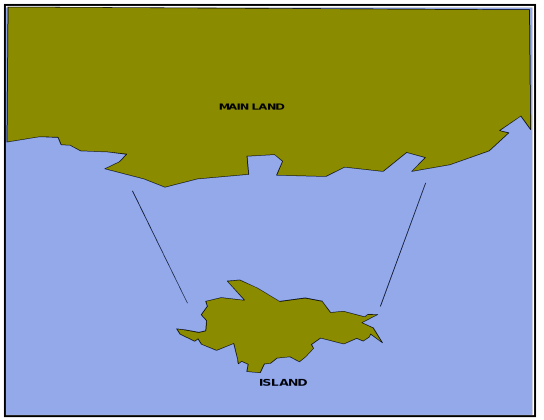


Choke Point Passage

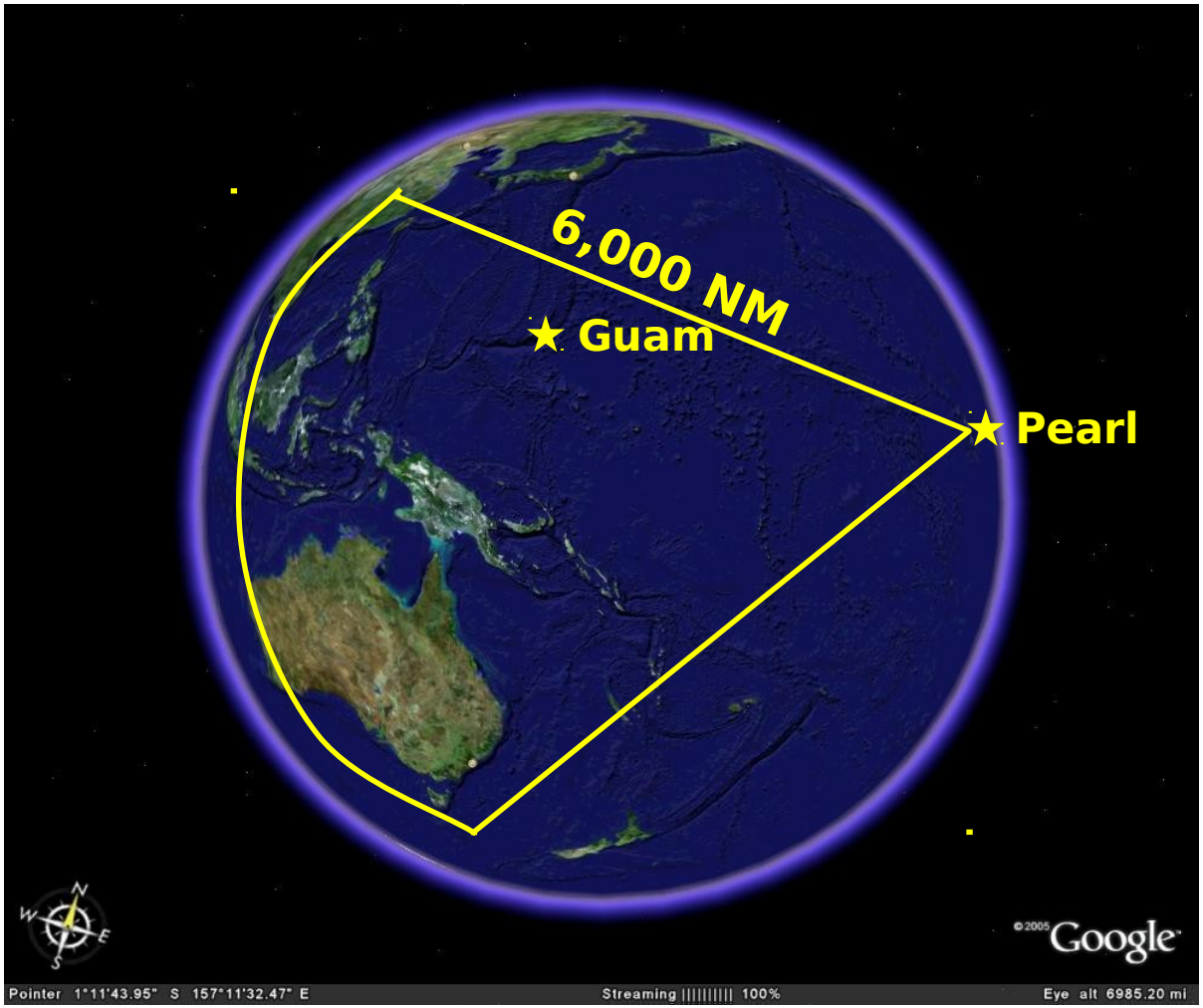




Defense of Island Na

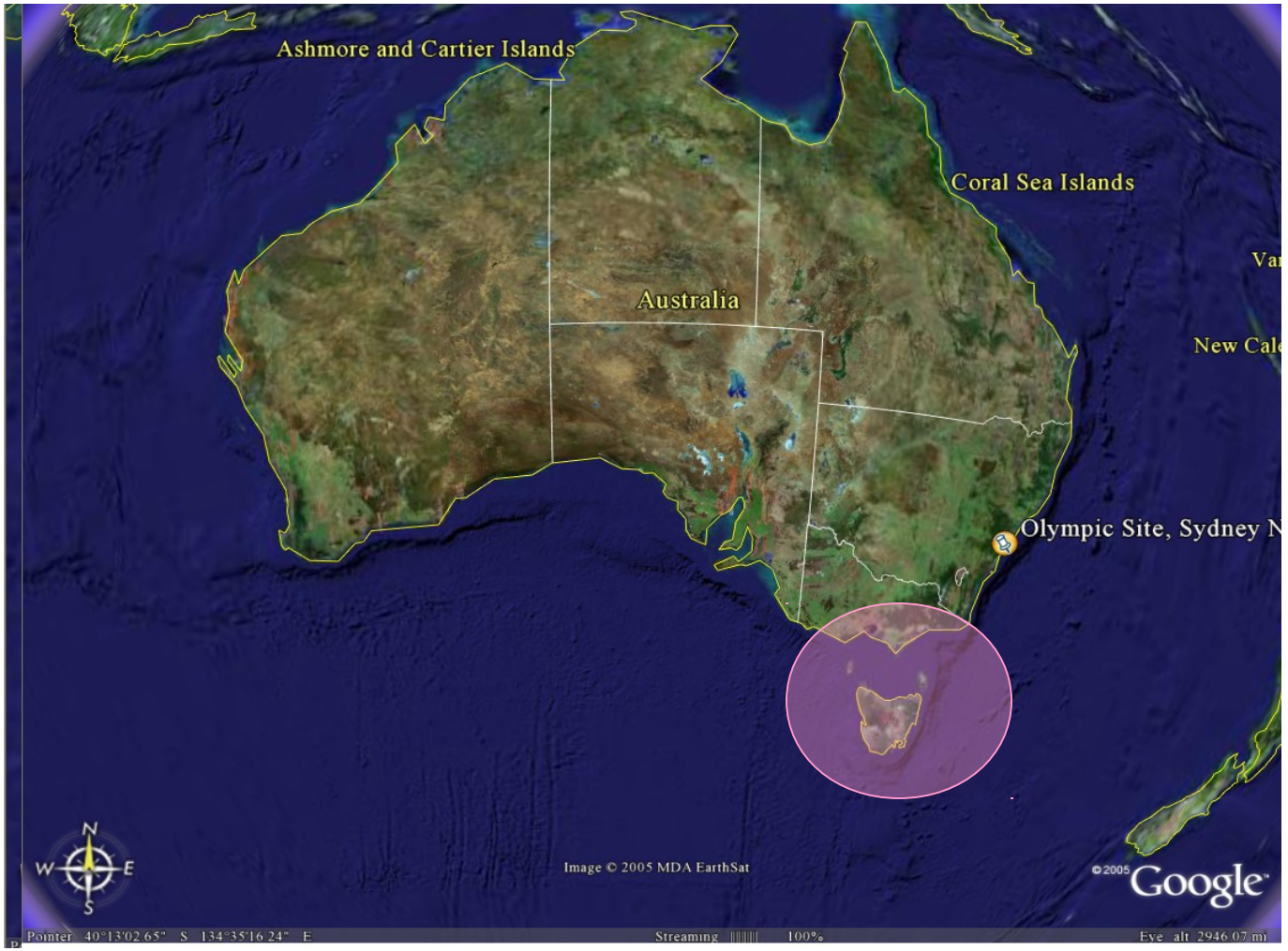


Scenario: Theater Logistics



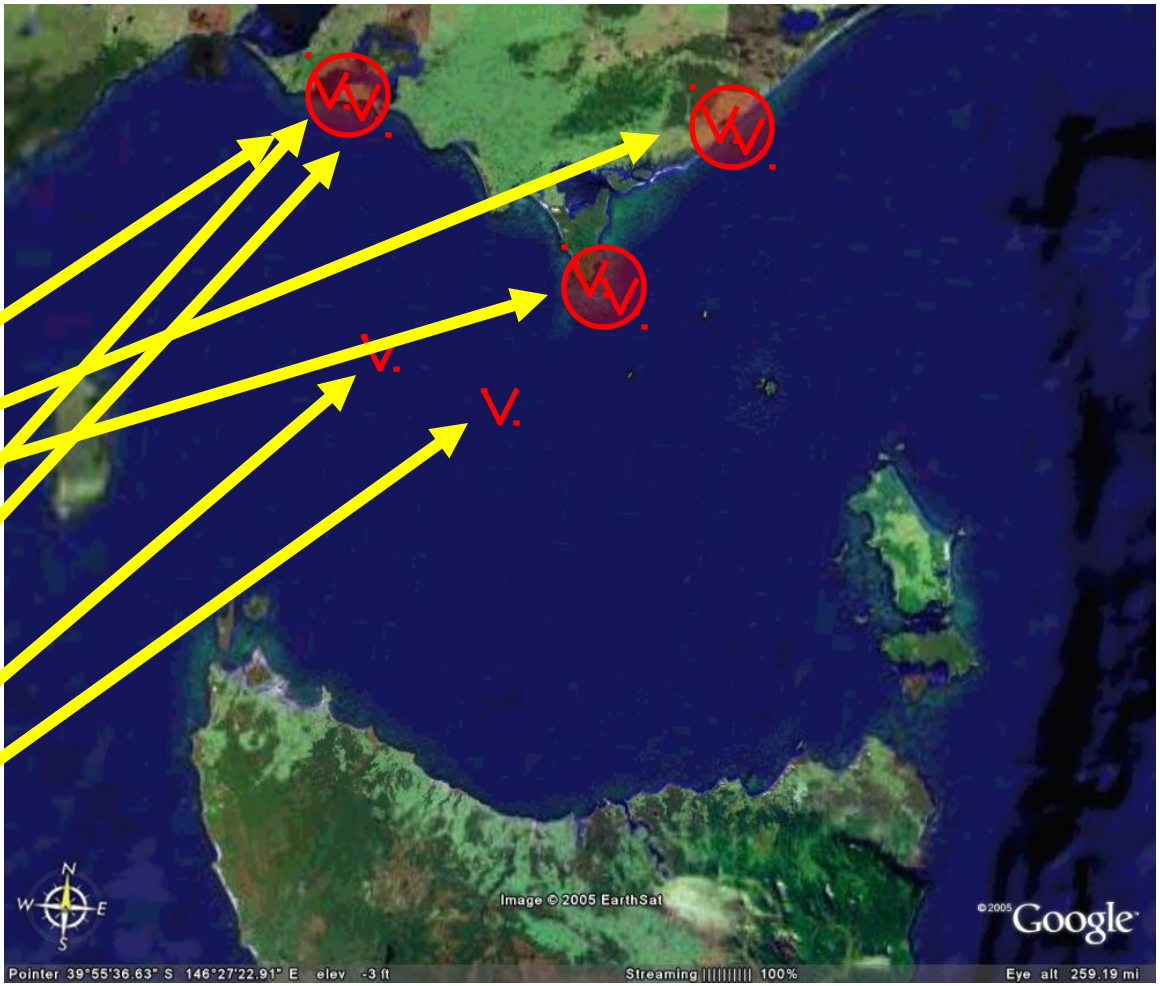
Specific Geographic Littoral ASW Scenario

- Used for geographical scenario planning and simulation
- Bass Strait - water space between Australia and Tasmania



Littoral ASW Scenario: Area of Responsibility (AOR)

- Defense of island nation
- Air and maritime superiority not established
- 3 enemy port facilities
- 2 enemy AIP submarines in each
- 2 enemy AIP submarines unlocated



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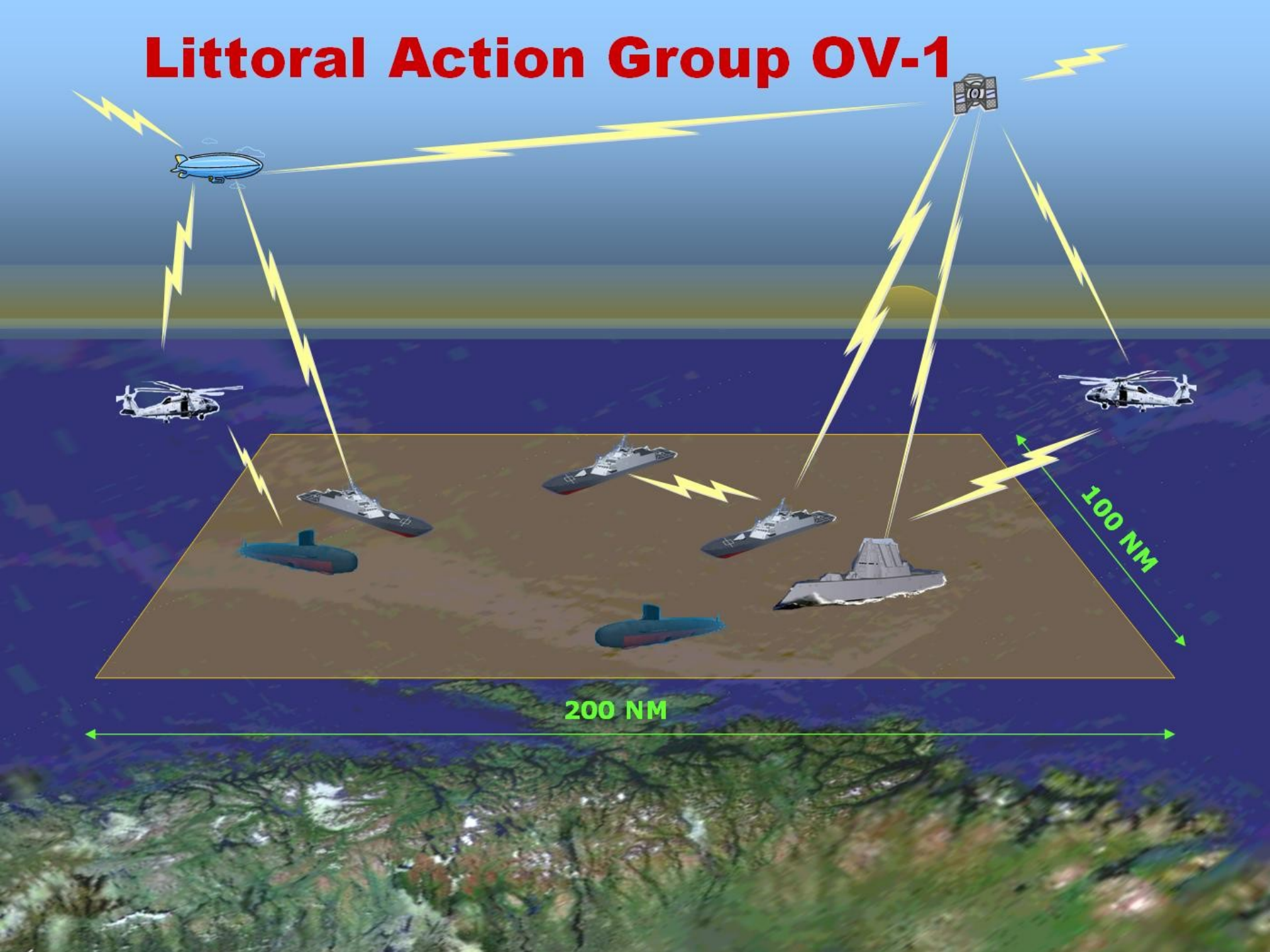
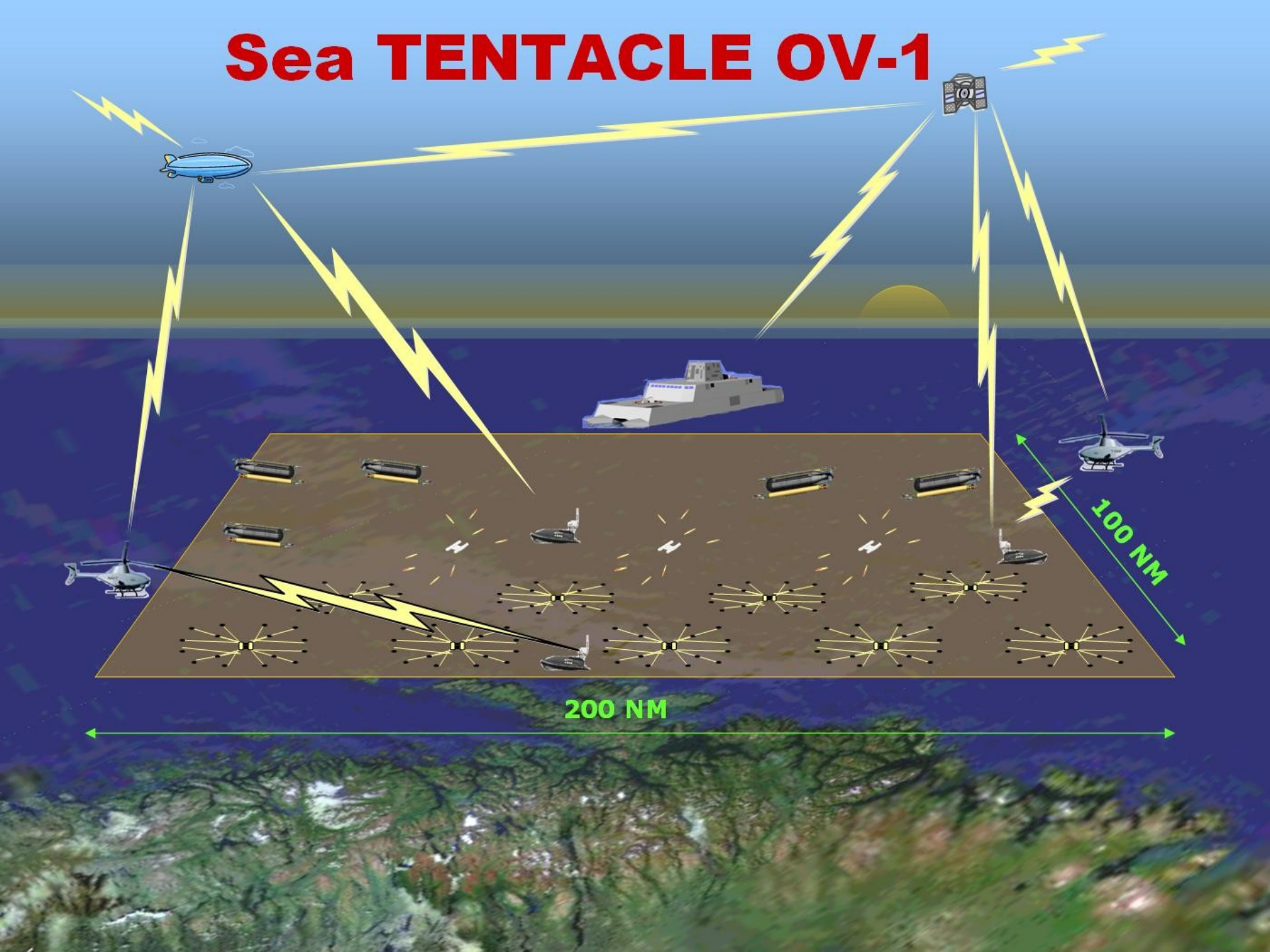
SEA-8 Defined Alternatives

- **Littoral Action Group (LAG)**
  - DD(X), LCS, SSN, MH-60
- **Total Ship Systems Engineering (TSSE) – Sea TENTACLE**
  - Host ship, UUV, USV, UAV, Stationary Bottom Sensors
- **Tripwire**
  - UUV, Rapidly Deployable Stationary Bottom Sensors
- **War of Machines**
  - UUV, Recharging Stations
- **Floating Sensors**

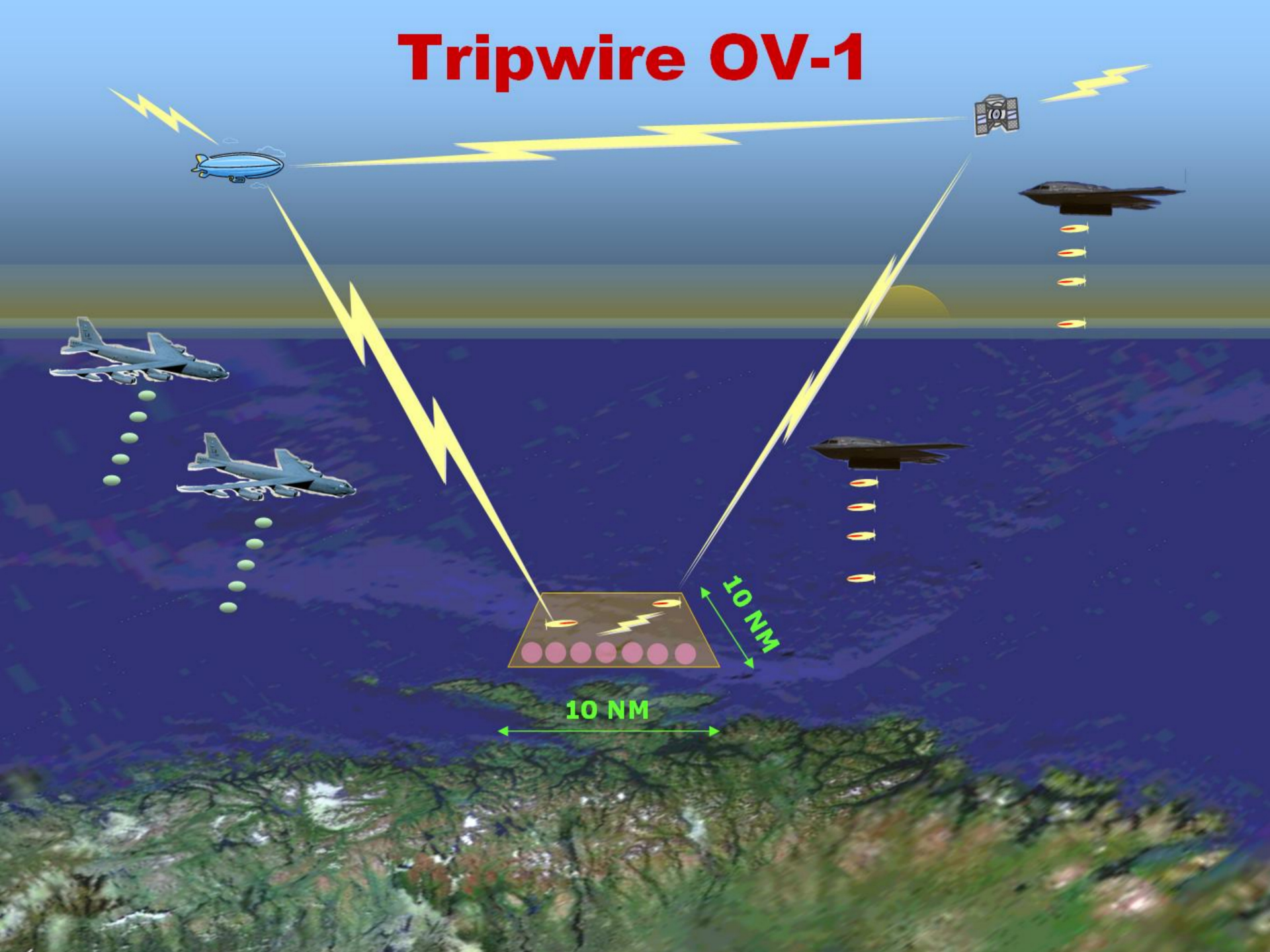
Littoral Action Group OV-1



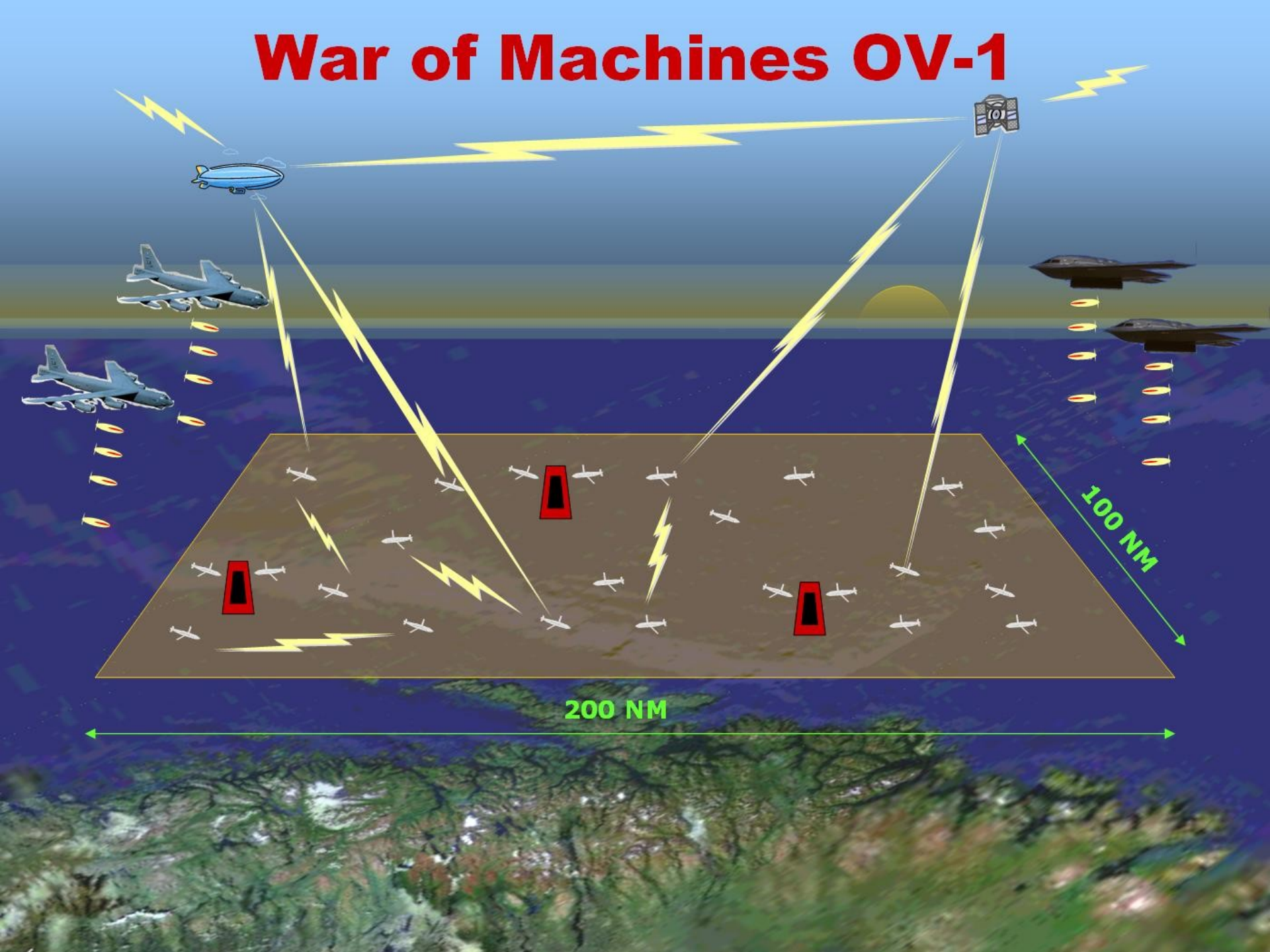
Sea TENTACLE OV-1

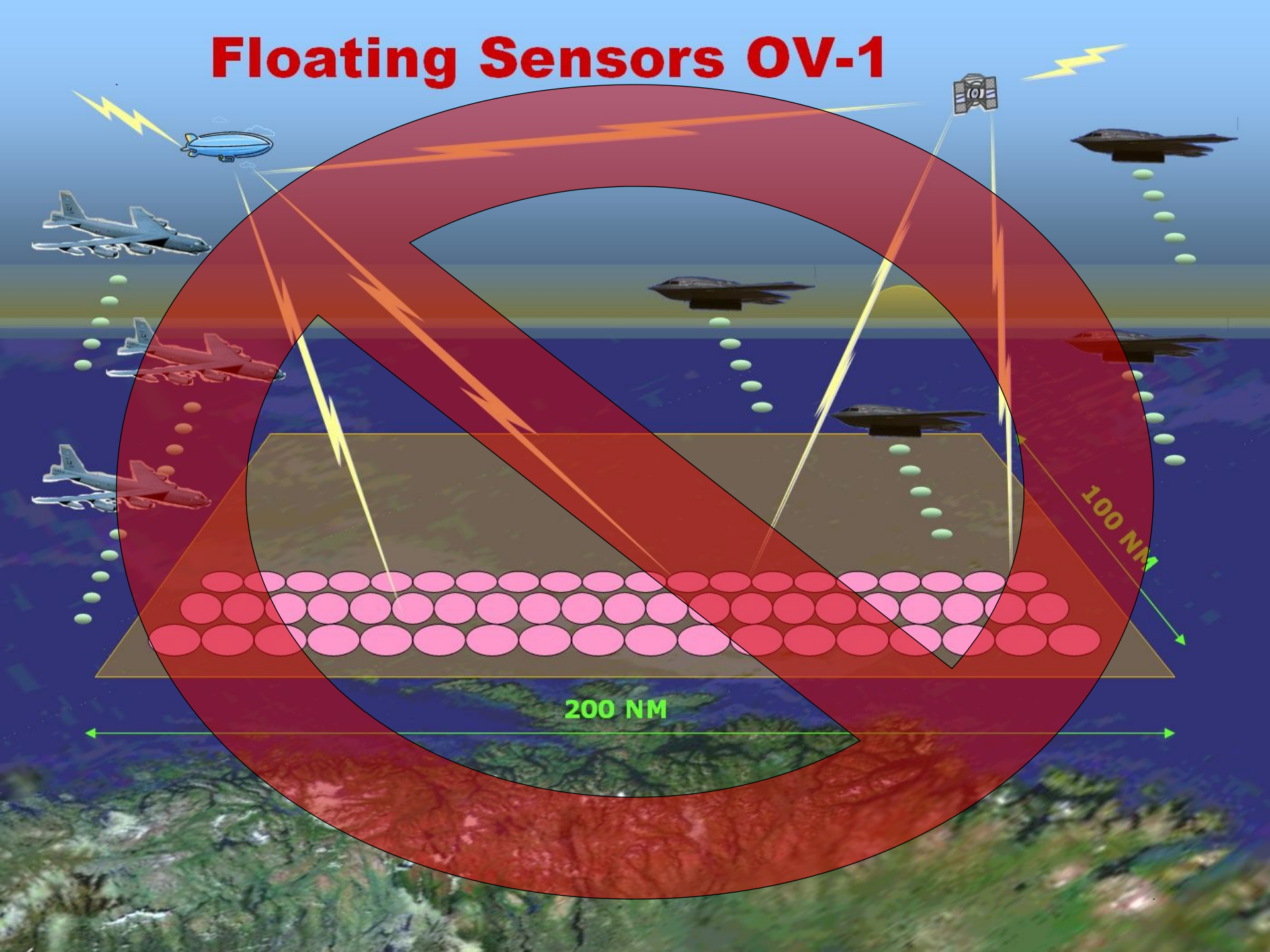


Tripwire OV-1



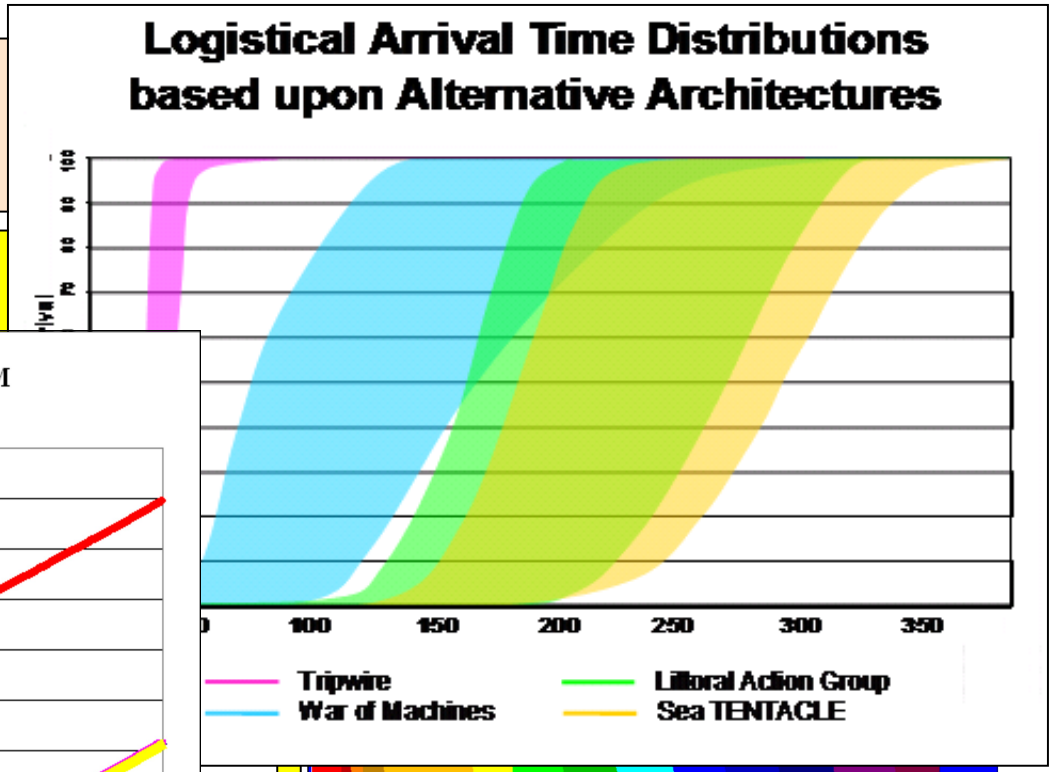
War of Machines OV-1

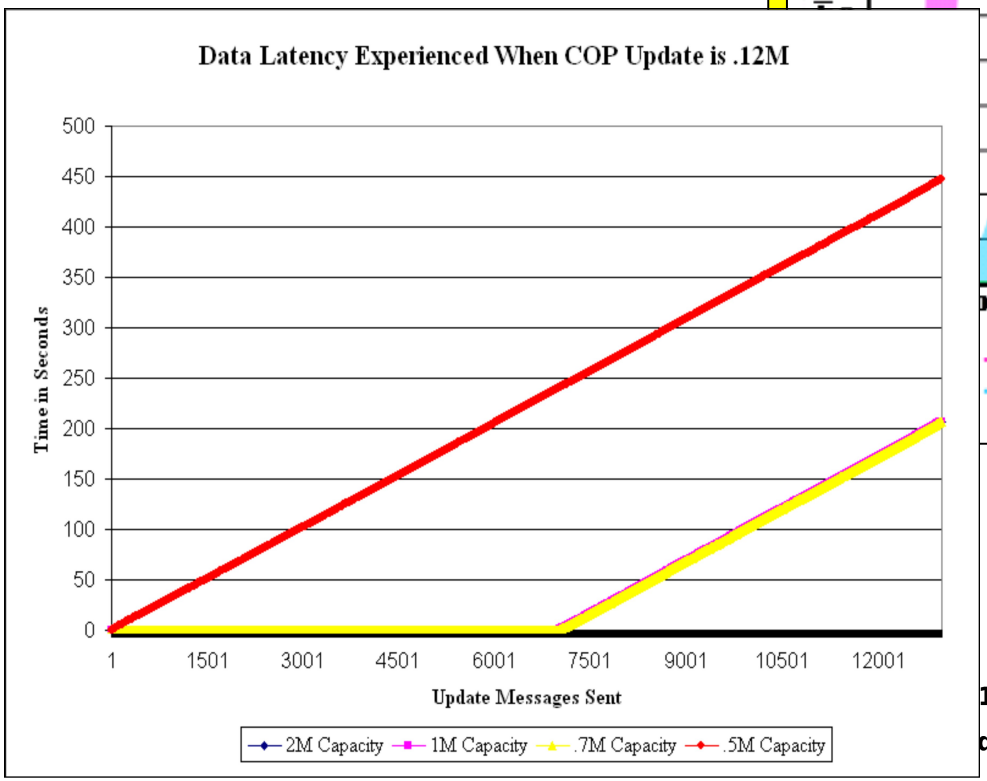


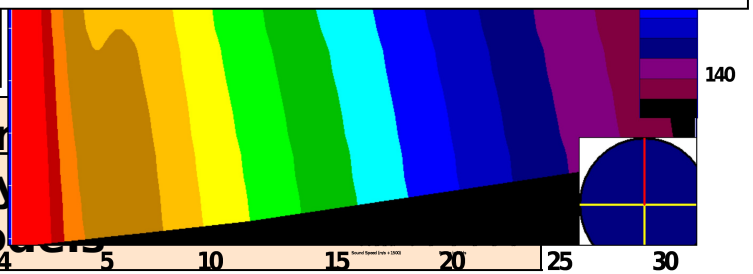

Floating Sensors OV-1
100 NM
200 NM

High-level Model Development

Reliability
discrete event simulation models







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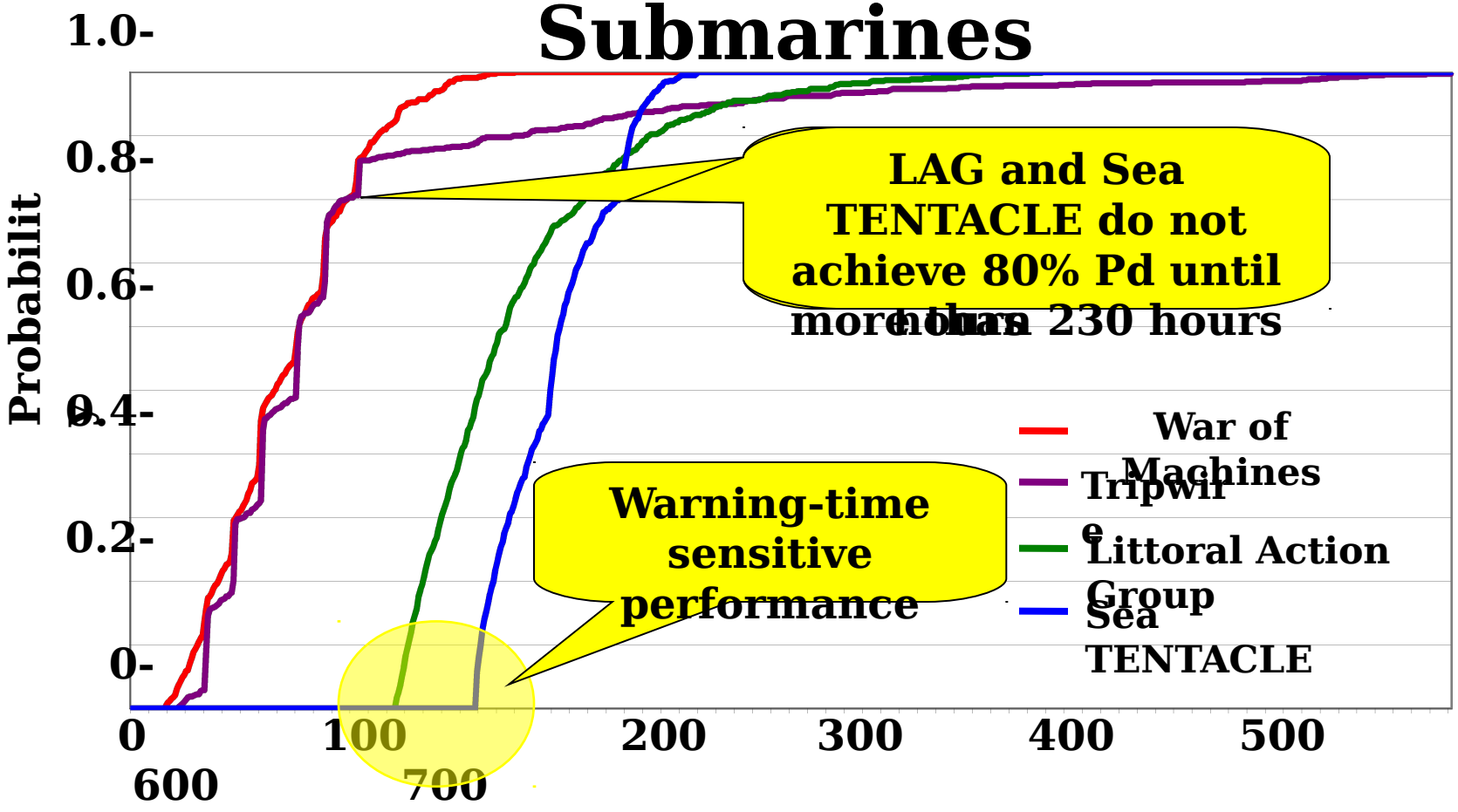
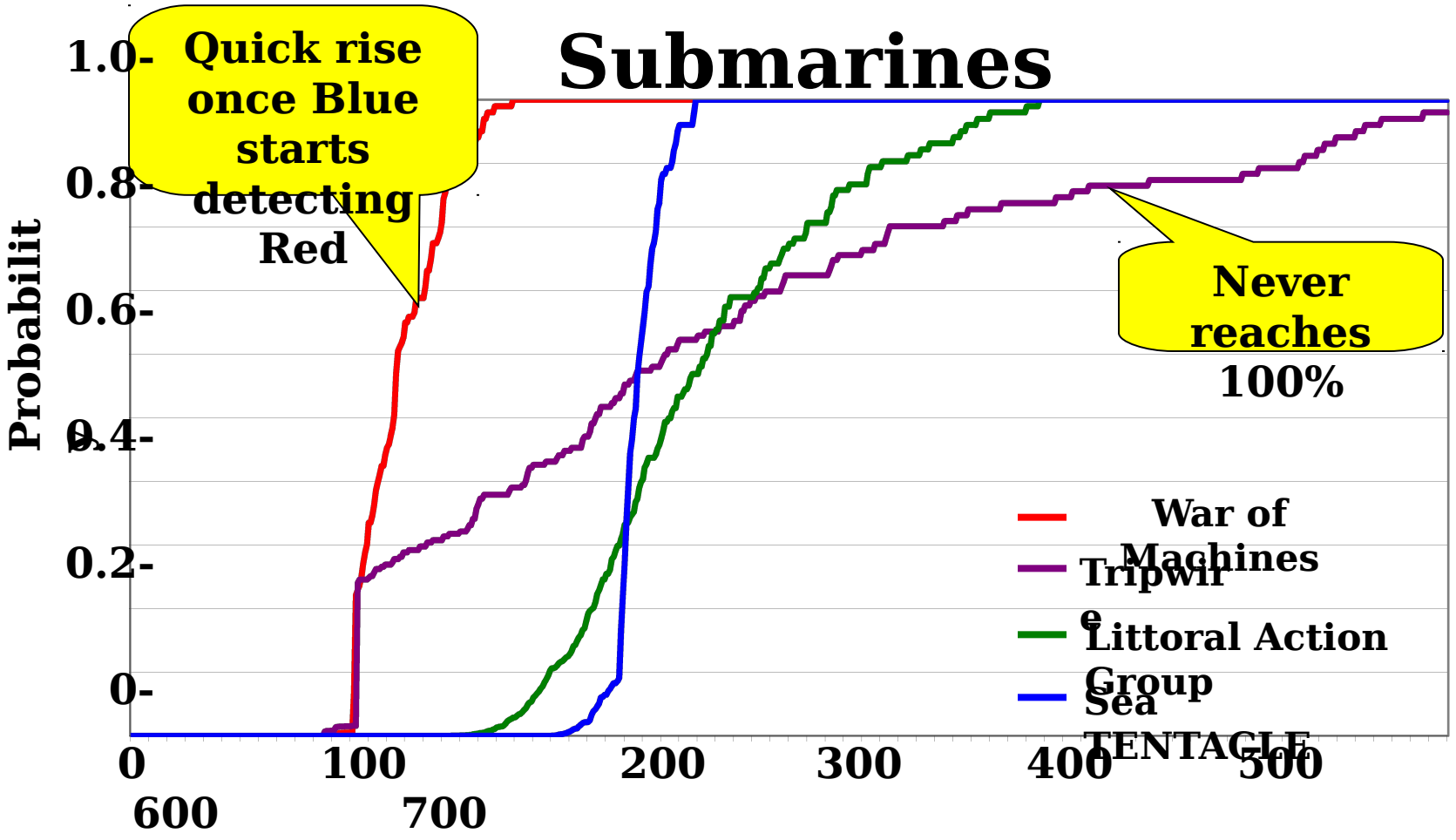
Alternatives' Strengths/Weaknesses

Time to INITIAL Detect of Red Submarines



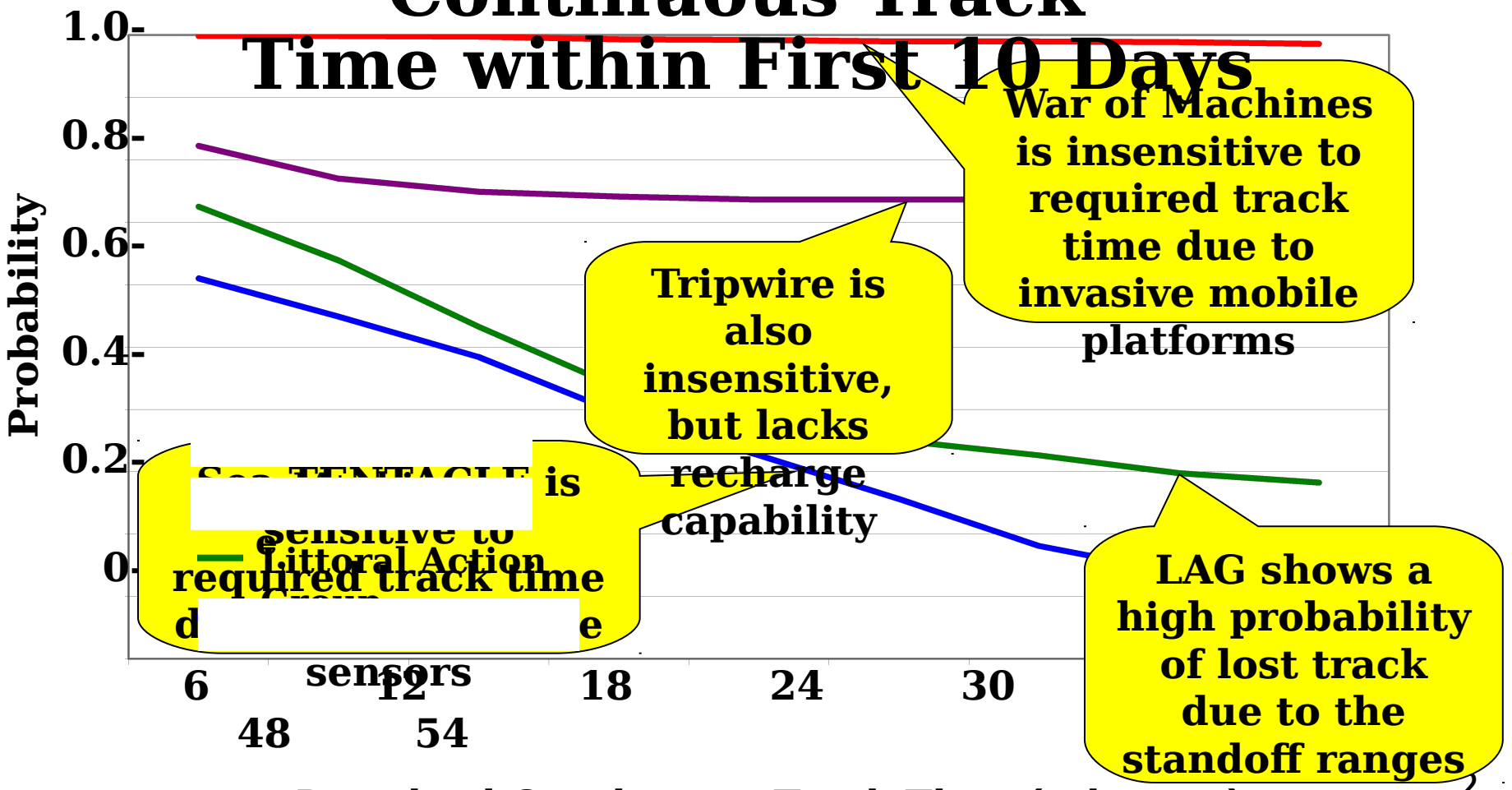
Alternatives' Strengths/Weaknesses

Time to Detect EACH of 8 Red Submarines



Tracking Ability

Sensitivity to Required Continuous Track Time within First 10 Days



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ASW Results, Insights and Recommendations

NO PERFECT SYSTEM

- Scenario variables were the key factors
- Each alternative studied had weaknesses
- Differences between alternatives were significant
- “Best” solution might be a tailored mix

ASW Results, Insights and Recommendations

REACTION TIME

- Enemy submarines are vulnerable in restricted waterways
- Enemy timelines are unpredictable
- Quick reaction systems hedge uncertainty
- Strategic air least sensitive to enemy initiative

ASW Results, Insights and Recommendations

PRESENCE

- Pervasive persistence is the goal
- Traditional methods
- Non-traditional methods

ASW Results, Insights and Recommendations

KILL-CHAIN TIMELINE (KCT) TRADEOFFS

- Traditional methods require short KCTs
- Non-traditional methods afford longer KCTs
- Standoff weapons systems more easily used if longer KCT are allowed

ASW Results, Insights and Recommendations

UNDERSEA JOINT ENGAGEMENT ZONE (UJEZ)

- Cooperative mix of assets unlocks future ASW force capabilities
- Future ASW forces may require the establishment of the UJEZ
- Low false positive and low fratricide rates are required

ASW Results, Insights and Recommendations

RECOMMENDATIONS

- Research
  - Follow on study
- Development
  - UUVs
  - Rapidly deployable sensing grids
  - Common undersea picture
  - Autonomous recharge/replenishment systems

ASW Results, Insights and Recommendations

RECOMMENDATIONS

- Tactics
  - Strategic air
  - JSOW like systems to deliver ASW assets
- Doctrine
  - Evolution from waterspace management and PMI to UJEZ

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